UCRL-JC-124743 Abs

AEROGEL CATALYSTS: SYNTHESIS, CHARACTERIZATION AND CATALYTIC BEHAVIOR*

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Sol-gel technology allows the incorporation of transition metal ions into the framework of a three-dimensional crosslinked "string of pearls" structure. The gel may then be processed to an *aerogel* under supercritical conditions to avoid collapse of the cell structure due to surface tension. Aerogel catalysts have many promising characteristics. First, the active site is present on a molecular basis, greatly increasing the available surface area for catalysis. In addition, the identity of the catalyst site is in principle more easily determined and controlled. Second, aerogel catalysts have high surface area, even after thermal treatment, ranging from 300 to 800 m^2/g. This surface area and their high porosity increase accessibility to the active site. Third, the aerogel catalysts may be prepared as transparent monoliths, allowing photocatalysis and reaction monitoring. Last, and an important engineering feature of these catalyst materials, is that they can be obtained as powders, films or monoliths. We have successfully prepared a range of metal oxide-matrix catalysts as transparent, homogeneous, monolithic solid materials. Silica, tantala, titania, zirconia and mixtures of metal oxides have all been used as the matrix material, while the metals include the early transition metals, such as Ti, V, Y, Zr, Nb, Ta and W, plus the lanthanides La and Sm. More recently, base metals such as Cu have been incorporated into the gelation process. In addition, a variety of matrix formulas have been used in encapsulating metal alloys or oxides of interest in an aerogel structure. The synthesis, characterization, modeling and reaction behavior of the aerogel catalysts will be presented.

*Work performed under the auspices of the U. S. Department of Energy by the Lawrence Livermore National Laboratory under Contract No. W-7405-ENG-48.